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|---|---|---|---|
| Application No. | Filing Date | Examiner | Group Art Unit |
| 09/786,499 | March 2, 2001 | Thompson, James | 2624 |
| Invention: SIGNAL PROCESSING | | | |

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| TRANSMITTAL OF APPEAL BRIEF (Large Entity) | Docket No. GJE-0004 |
|---|---|

In Re Application Of: **Michael Hobson et al.**

| Application No. | Filing Date | Examiner | Customer No. | Group Art Unit | Confirmation No. |
|---|---|---|---|---|---|
| 09/786,499 | March 2, 2001 | Thompson, James | 23413 | 2624 | 1435 |

Invention: **SIGNAL PROCESSING**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
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| Applicant: MICHAEL HOBSON, ET AL. | Group Art Unit: 2624 |
| Serial No. 09/786,499 | Examiner: Thompson, James |
| Filed: March 2, 2001 | |
| For: SIGNAL PROCESSING | |

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APPEAL BRIEF

REAL PARTY IN INTEREST

The real party in interest is Wallac, OY, the assignee of record as recorded at reel/frame 012806/0953.

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RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences.

STATUS OF CLAIMS

Claims 1-3 and 5-16 stand rejected.

The rejections of claims 1-3 and 5-16 are herein appealed.

STATUS OF AMENDMENTS

An amendment was filed on June 23, 2006, after the rejection of March 23, 2006. The amendment was entered, and the claims were finally rejected on September 21, 2006.

It should be noted that the version of claim 3 attached to the Amendment of June 23, 2006 contained typographical errors. Claim 3 has not been amended. The correct version of claim 3, in its original form, is attached in the Claim Appendix.

SUMMARY OF CLAIMED SUBJECT MATTER

A concise explanation of the subject matter defined in independent claim 1 involved in the appeal is provided below.

**Claim 1**

Claim 1 is directed to a method of reconstructing a previously produced signal from a given set of data, with a prediction function representing a predictable effect on the signal, and a noise function representing unpredictable noise. The method may be used to deblur an image, as described at page 14 of the specification. According to an exemplary embodiment, the speed and accuracy of reconstruction are improved by making a change in basis in both the signal and data spaces and performing a Bayesian reconstruction in the new basis.

According to an exemplary embodiment, the coordinate basis of the data and signal is altered from an original coordinate basis in order to produce a prediction function having a reduced set of variables. As described, e.g., at pages 8-10 of the specification, the basis is chosen in the data and signal spaces so that the relationship



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between the data vector and the signal vector is simplified. This change in basis permits reconstruction to be applied to signals than can take positive, negative or complex values compared to conventional techniques that only allow reconstruction of non-negative values. This enables a signal to be reconstructed by performing a large number of numerical maximizations of low dimensionality, rather than a single maximization of high dimensionality. This results in simpler mathematical computations and in a significant increase in speed. In one example, described at page 3 of the specification, the speed of reconstruction is increased by a factor of about 100.

According to exemplary embodiments, a Bayesian reconstruction capable of operation of positive, negative, and complex signal values is performed to produce a reconstruction signal, and the reconstruction signal is converted back into the original coordinate basis to generate a signal. As explained, e.g., at page 8 of the specification, the ability to reconstruct positive/negative and complex distributions has profound consequences for greatly improving the speed and accuracy of reconstruction.

The method enables a signal to be reconstructed within a reduced time frame. As an example, the method enables a stack of twenty microscope images to be reconstructed using a Pentium 200 MHz processor after forty-five seconds compared to fifty minutes to reconstruct the twenty microscope images using conventional reconstruction techniques (See pp. 1 and 2 of specification).

The above exemplary embodiments are discussed with respect to the aforementioned independent claim by way of example only and are not intended to in any way limit the scope of the claims.

## GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-3 and 5-16 were rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter.

Claims 1-2, 5-8, and 10 were rejected under 35 U.S.C. § 103 as being unpatentable over Knaell (U.S. Patent No. 5,394,151) in view of Spencer (U.S. Patent No. 5,535,291).

Claims 3 and 9 were rejected 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer and Clarke (U.S. Patent No. 5,799,100).

Claims 11, 12, and 15 were rejected under 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer and Hofstein (U.S. Patent No. 4,099,179).

Claims 13 and 16 were rejected under 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer, Hofstein, and Bahorich. (U.S. Patent No. 5,226,019).

Claim 14 was rejected 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer and Larson (U.S. Patent No. 5,252,922).

ARGUMENT

**Rejection of claims 1-3 and 5-16 under 35 U.S.C. § 101**

Clams 1-3 and 5-16 were rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter. The Examiner asserts that the claims merely recite performing mathematical functions on a set of data values encoded in a signal and reasons that the claims are thus not directed to statutory subject matter. The Examiner concludes that the claims do not provide a concert, tangible and useful result.

According to the Guidelines for Examination of Applications for Compliance with the Utility Requirement set forth in MPEP 2106, the Examiner must take certain steps in determining whether a claimed invention meets the requirements of Section 101. In particular, the Examiner must identify and understand any utility or practical application asserted for the invention and determine whether the claimed invention falls within an enumerated category. If the claimed invention does not fall within an enumerated category, then Examiner must take further steps to determine whether the claimed invention covers either a 35 U.S.C. 101 judicial exception or a practical application of a 35 U.S.C. 101 judicial exception and determine whether the claimed invention is a practical application of an abstract idea, law of nature or natural phenomenon.

A claimed invention is directed to a practical application of a 35 U.S.C. 101 judicial exception when it:

(A) "transforms" an article or physical object to a different state or thing; or

(B) otherwise produces a useful, concrete and tangible result, based on the factors discussed below.

Claim 1 recites a method of reconstructing a previously produced signal from a given set of data, the method including a step of converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal. Applicants respectfully submit that the claimed subject matter has a practical application in that it transforms a signal into a reconstructed signal. Further, the claimed reconstruction of the previously produced signal is considered to be useful, tangible, and concrete in that it is a real-world repeatable result with a practical application, such as the de-blurring of a microscope image, described at page 14, lines 7-11 of the specification. Accordingly, the subject matter recited in claim 1 is considered to fulfill the requirements of Section 101.

**Rejection of claims 1-2, 5-8 and 10 under 35 U.S.C. § 103**

Claims 1-2, 5-8, and 10 were rejected under 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer. Claim 1 recites a method of reconstructing a previously produced signal from a given set of data, the set of data characterized by a first prediction function representing a predictable effect of an apparatus on the previously produced signal, and a noise function representing unpredictable noise contributed to the previously produced signal. The method comprises <u>altering an original coordinate basis of the set of data to produce at least one other coordinate basis, the at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis, the set of data in the at least one other coordinate basis represented by a second prediction function of the previously produced signal in the at least one other coordinate basis</u>. The method further comprises performing a Bayesian reconstruction utilizing the second prediction function to produce a reconstruction signal, the Bayesian reconstruction utilizing a maximum entropy method capable of operation on positive, negative, and complex values, and <u>converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal</u>.

In rejecting claim 1, the Examiner cites Knaell as disclosing a method of reconstructing an image from a signal, the method comprising altering an original coordinate basis of the object to product at least one other coordinate basis, the at least

one other coordinate basis having a plurality of spaces. Applicants respectfully disagree.

The Action points to cols. 4-5 and 7-8 and FIG. 3A of Knaell as allegedly disclosing altering an original coordinate basis of a set of data to another coordinate basis having a lower dimensionality. The Action alleges that in Knaell, the original data corresponding to an object is altered from a three-dimensional coordinate basis to a two-dimensional coordinate basis. However, the cited portions of Knaell describe and illustrate three-dimensional imaging based on data obtained when a radar antenna is sequentially positioned along on a curvilinear line in space. The image that results in Knaell is a three-dimensional image, as is evident from FIGS. 5A and 5B of Knaell. The three dimensional image is obtained by repositioning a radar antenna that obtains two-dimensional data. Thus, Knaell does not teach producing at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis. On the contrary, Knaell teaches obtaining data of a higher dimensionality than original data. Furthermore, Knaell's teaching of rotating an antenna, described at col. 8, ll. 3-10, does not result in the creation of one or more other coordinate bases for the data collected by the antenna, nor a plurality of spaces within such other coordinate bases having a lower dimensionality than a space in the original coordinate basis, as recited in claim 1.

The Action admits that Knaell fails to teach a method of reconstructing a previously produced signal from a given set of data, the set of data characterized by a first prediction function representing a predictable effect of an apparatus on the previously produced signal, and a noise function representing unpredictable noise contributed to the previously produced signal. The Action further admits that Knaell fails to disclose or suggest converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal. The Action relies on Spencer for the features missing from Knaell.

Spencer discloses a method for enhancing an image, including restoring an image using deconvolution and superresolution techniques (See cols. 4 and 5). Applicants respectfully submit that one skilled in the art would not have been led to combine Spencer with Knaell in the manner suggested because Spencer and Knaell describe vastly

different image processing approaches. Knaell uses three-dimensional imaging based on repositioning of a radar antenna, while Spencer discloses enhancing a signal using complex operations. If Knaell and Spencer were combined, what would result is an image in a form achieved using complex operations. One skilled in the art simply would not have been led to the teachings of Spencer in modifying the teachings of Knaell, as such a modification would result in complex operations without any benefit. Thus, the rejection of claim 1 under Section 103 is considered improper.

Moreover, the proposed combination of Knaell and Spencer fails to disclose or suggest all the features recited in claim 1. In particular, Spencer fails to disclose or suggest converting the reconstruction signal back into the original coordinate basis to generate the prosily reproduced signal, a feature that the Action admits is missing from Knaell. The portions of Spencer pointed out by the Examiner relate to image restoration. However, nowhere in Spencer is there a disclosure or suggestion of converting the reconstruction signal back into the original coordinate basis as set forth in claim 1.

In addition, Spencer fails to disclose or suggest altering an original coordinate basis of the set of data to produce at least one other coordinate basis, the at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis, the set of data in the at least one other coordinate basis represented by a second prediction function of the previously produced signal in the at least one other coordinate basis as set forth in claim 1. As explained above, these features are also missing from Knaell.

Thus, even if Knaell and Spencer were properly combined, the claimed subject matter set forth in claim 1 would not result. Accordingly, claim 1 is considered allowable.

Claims 2, 5-8 and 10 depend from claim 1 and are considered to be allowable over for at least the same reasons.

**Rejection of claims 3 and 9 under 35 U.S.C. § 103**

Claims 3 and 9 were rejected 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer and Clarke.

Claims 3 and 9 depend ultimately from claim 1 and thus contain at least the same features as claim 1. As explained above, the combination of Knaell and Spencer is considered improper as one skilled in the art would not have found it obvious to combine these documents in the manner suggested. Moreover, as noted above, claim 1 recites altering an original coordinate basis of the set of data to produce at least one other coordinate basis, the at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis, the set of data in the at least one other coordinate basis represented by a second prediction function of the previously produced signal in the at least one other coordinate basis, and converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal. These features, which are missing from Knaell and Spencer, are not shown by Clark. Thus, claims 3 and 9 are considered allowable.

**Rejection of claims 11, 12 and 15 under 35 U.S.C. § 103**

Claims 11, 12, and 15 were rejected under 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer and Hofstein.

Claims 11, 12, and 15 depend ultimately from claim 1 and thus contain at least the same features as claim 1. As explained above, the combination of Knaell and Spencer is considered improper as one skilled in the art would not have found it obvious to combine these documents in the manner suggested. Moreover, as noted above, claim 1 recites altering an original coordinate basis of the set of data to produce at least one other coordinate basis, the at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis, the set of data in the at least one other coordinate basis represented by a second prediction function of the previously produced signal in the at least one other coordinate basis, and converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal. These features, which are missing from Knaell and Spencer, are not shown by Hofstein. Thus, claims 11, 12, and 15 are considered allowable.

**Rejection of claims 13 and 16 under 35 U.S.C. § 103**

Claims 13 and 16 were rejected under 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer, Hofstein, and Bahorich.

Claims 13 and 16 depend ultimately from claim 1 and thus contain at least the same features as claim 1. As explained above, the combination of Knaell and Spencer is considered improper as one skilled in the art would not have found it obvious to combine these documents in the manner suggested. Moreover, as noted above, claim 1 recites altering an original coordinate basis of the set of data to produce at least one other coordinate basis, the at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis, the set of data in the at least one other coordinate basis represented by a second prediction function of the previously produced signal in the at least one other coordinate basis, and converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal. These features, which are missing from Knaell and Spencer, are not shown by Hofstein and Bahorich. Thus, claims 11, 12, and 15 are considered allowable.

**Rejection of claim 14 under 35 U.S.C. § 103**

Claim 14 was rejected 35 U.S.C. § 103 as being unpatentable over Knaell in view of Spencer and Larson.

Claim 14 depends from claim 1 and thus contains at least the same features as claim 1. As explained above, the combination of Knaell and Spencer is considered improper as one skilled in the art would not have found it obvious to combine these documents in the manner suggested. Moreover, as noted above, claim 1 recites altering an original coordinate basis of the set of data to produce at least one other coordinate basis, the at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis, the set of data in the at least one other coordinate basis represented by a second prediction function of the previously produced signal in the at least one other coordinate basis, and converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal. These features, which are missing from Knaell and Spencer, are not shown by Larson. Thus, claim 14 is considered allowable.

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CONCLUSION

In view of the foregoing, it is urged that the final rejection of claims 1-3 and 5-16 be reversed.

The fee as set forth in 37 CFR § 41.20(b)(2) is enclosed herewith.

If there are any charges with respect to this Appeal Brief or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' attorneys.

Respectfully submitted,

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CLAIM APPENDIX

1. A method of reconstructing a previously produced signal from a given set of data, the set of data characterized by a first prediction function representing a predictable effect of an apparatus on the previously produced signal, and a noise function representing unpredictable noise contributed to the previously produced signal, the method comprising the steps of:

altering an original coordinate basis of the set of data to produce at least one other coordinate basis, the at least one other coordinate basis having a plurality of spaces with a lower dimensionality than a space within the original coordinate basis, the set of data in the at least one other coordinate basis represented by a second prediction function of the previously produced signal in the at least one other coordinate basis;

performing a Bayesian reconstruction utilizing the second prediction function to produce a reconstruction signal, the Bayesian reconstruction utilizing a maximum entropy method capable of operation on positive, negative, and complex values; and

converting the reconstruction signal back into the original coordinate basis to generate the previously produced signal.

2. A method according to claim 1, wherein the Bayesian reconstruction is performed using a Fourier basis.

3. A method according to claim 1, wherein the Bayesian reconstruction is performed using a wavelet basis.

5. A method according to claim 1, employing an evaluation parameter, $\propto$, which is determined from a prior reconstruction.

6. A method according to claim 1, employing an evaluation parameter, $\propto$, which is set at a fixed value.

7. A method according to claim 1, employing an evaluation parameter, $\propto$, which is determined during the reconstruction step.

8. A method according to claim 1, wherein the previously produced signal to be reconstructed is an image signal.

9. A method according to claim 8, wherein the image signal is a medical image signal.

10. A method according to claim 1, wherein the previously produced signal to be reconstructed is a radar signal.

11. A method according to claim 1, wherein the previously produced signal to be reconstructed is an acoustic data signal.

12. A method according to claim 11, wherein the acoustic data signal is an underwater sonar signal.

13. A method according to claim 11, wherein the acoustic data signal is a geophysical data signal.

14. A method according to claim 1, wherein the previously produced signal to be reconstructed is a signal from spectroscopy.

15. A method according to claim 1, wherein the previously produced signal is a communication signal.

16. A method according to claim 15, wherein the communication signal is a time-series signal.